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The Mineral Industry of Finland

UNITED STATES DEPARTMENT OF THE INTERIOR

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The Mineral Industry of Finland

By Richard H. Singleton[1]

The Finnish minerals industry continued to be remarkably robust considering its very limited reserves. Its high expertise in minerals and metallurgical engineering continued to be exported in the form of equipment, plant design and construction, and consultation.

The minerals industry accounted for approximately 3% of Finland's gross domestic product (GDP). An approximate breakdown by value of the $2.5 billion[2] per year industry's production was primary metals, 80%; industrial minerals, 10%; and ore and concentrates, 10%. Steel, including stainless, accounted for about 80% of metals production, and most of the remainder was ferrochrome, copper, zinc, and nickel, in order of value. Cement comprised about one-third of the value of Finland's industrial minerals output, followed by sulfur, stone, talc, lime, and phosphate rock, in order of value. Iron ore accounted for about one-third of the value of metal concentrates production, followed by chromite, nickel, gold, zinc, and silver, in order of value. With ore reserves rapidly approaching exhaustion, metal mining was expected to come to a complete halt by the end of this century. Chromite was the exception; reserves were sufficient for well into the next century and perhaps beyond. The dwindling reserves have caused Outokumpu Oy, the major producer of all ores except iron, to look to foreign sources. It now owns the Tara Mine in Ireland, the largest lead-zinc mine in Europe, and the Viscaria Mine in Sweden, Europe's largest copper mine. The company also controls smaller copper-zinc mines in Norway. Approximately two-thirds of the feed for Outokumpu's smelters was imported during 1987.

Cobalt mining was terminated because of high production costs and low world market prices. A nickel-copper reserve mine and a zinc-copper mine were closed permanently because the ore was exhausted. Steel production continued as an economically viable industry despite a heavy debt load from modernization over past years. The industry was dependent mainly on imported iron ore. Finland's domestic iron mine, operating at a loss, was kept open primarily to support employment. Gold and silver mining increased while that of copper, iron, and nickel decreased. Imports of copper concentrate increased. Mine output of two industrial minerals, barite and pyrite, increased.

Finland became a significant world mica producer with the opening of a beneficiation plant that processed byproduct from a phosphate rock mine. Ammonia production decreased, but a new ammonia plant based on peat was under construction. A major talc deposit was being evaluated on a pilot basis.

Finland continued to be dependent on imports, mostly crude oil from the U.S.S.R., for about two-thirds of its energy supply. Total energy consumption increased by 10%. Peat production was down by about 50% because wet weather, especially in June, slowed mining. Projected significant increases in the already-high per capita energy demand, 5.9 tons of oil equivalent per capita and 90% above the average for Western Europe, resulted in construction and planned construction of a significant number of powerplants based on peat, coal, and natural gas.

Finland's economy became more robust as the real GDP increased by nearly 4% to approximately $88 billion, a significant improvement over the 1986 increase. The balance of trade remained slightly positive

although the balance of payments continued to weaken. A sharp drop in exports to the U.S.S.R. was more than offset by increased exports, especially of forest products, to Western Europe. Exports of metals, engineering equipment, and expertise decreased slightly. Import demand increased with the appreciation of the finnmark, although imports from the U.S.S.R. (about 70% mineral fuels) decreased significantly in 1987 to 14% of the total. Total Finnish exports and imports were each 22% of the GDP. U.S. exports to and imports from Finland were each about 5% of Finland's total imports and exports, respectively.

PRODUCTION

Production of concentrates of cobalt, copper, iron, and nickel decreased, mostly as a reflection of decreasing reserves of ore. Cobalt mining was terminated during the year. Gold and silver mining each increased significantly, much of it as byproducts of base metal mining. Production of cadmium increased. Selenium output partially recovered after its large drop in 1986.

Mined output of barite and pyrite each increased. The barite, most of which was exported, was a byproduct of Outokumpu's Phyasalmi copper-zinc mine. Production of ammonia decreased significantly. Oil-refinery output increased.

Table 1.—Finland: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Aluminum, secondary	13,200	17,100	21,000	22,200	22,200
Cadmium, refined	616	614	565	522	690
Chromium: Chromite:					
Gross weight:					
Lump ore thousand tons	85	312	327	r e350	338
Concentrate do.	141	119	167	188	192
Foundry sand do.	19	15	12	12	13
Total do.	245	446	506	e550	543
Cr_2O_3 content:					
Lump ore do.	24	r84	r e88	r e95	e91
Concentrate do.	58	47	67	r e75	e77
Foundry sand do.	9	7	r e6	r e5	e6
Total do.	91	138	161	e175	e174
Cobalt:					
Mine output, Co content	r930	r860	720	627	190
Metal, refined	1,550	1,453	1,427	1,348	500
Copper:					
Mine output, Cu content	r37,861	r30,834	27,897	25,987	20,398
Metal:					
Smelter	r70,100	r77,600	68,900	84,460	80,888
Refined	55,376	57,318	58,766	64,235	e60,000
Gold troy ounces	25,206	28,067	19,130	37,680	e58,000
Iron and steel:					
Iron ore, marketable, all types:[3]					
Gross weight thousand tons	1,277	1,231	1,122	973	896
Fe content do.	822	r806	738	635	588
Metal:					
Pig iron do.	1,898	2,044	1,891	1,978	2,063
Ferroalloys, ferrochromium do.	59	59	133	134	143
Steel, crude do.	2,416	r2,632	2,518	2,586	2,669
Semimanufactures, rolled do.	1,964	1,985	2,063	1,997	2,025
Lead:					
Mine output, Pb content	2,125	2,478	2,422	1,980	e2,250
Refined, secondary	6,000	e4,500	4,600	1,200	e1,200
Mercury 76-pound flasks	1,857	2,292	3,630	4,239	4,178
Molybdenum metal	218	265	326	256	262

See footnotes at end of table.

Table 1.—Finland: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS —Continued					
Nickel:					
Mine output, Ni content	5,314	r6,918	8,547	11,886	10,557
Metal, electrolytic	14,837	15,282	15,656	17,791	15,392
Platinum-group metals:					
Palladium troy ounces	2,283	1,093	1,125	3,086	e3,100
Platinum do.	2,186	1,061	1,125	3,858	e3,900
Selenium kilograms	11,172	16,975	14,038	5,693	e10,000
Silver thousand troy ounces	960	1,123	998	1,193	1,415
Vanadium: Mine output, V_2O_5 content	5,694	5,469	3,805	--	--
Zinc:					
Mine output, Zn content	55,913	60,200	60,606	60,351	e55,000
Metal	155,336	158,819	160,377	155,397	151,500
INDUSTRIAL MINERALS					
Barite	3,400	8,704	8,690	6,969	11,000
Cement, hydraulic thousand tons	r1,886	1,645	1,608	1,422	1,426
Feldspar	52,066	56,265	52,940	47,049	52,000
Mica, flake	--	--	--	--	e5,000
Lime thousand tons	231	241	252	261	271
Nitrogen: N content of ammonia	67,700	68,700	65,100	66,800	50,300
Phosphate rock, apatite concentrate:					
Gross weight thousand tons	381	477	512	527	553
P_2O_5 content do.	141	176	178	185	195
Pyrite, gross weight do.	499	426	493	547	621
Sodium sulfate[e] do.	35	35	35	35	e35
Stone, crushed:					
Limestone and dolomite:					
For cement manufacture do.	2,609	2,287	2,217	1,968	e1,750
For agriculture do.	1,370	1,192	1,453	1,108	e1,050
For lime manufacture do.	344	367	357	381	e330
Fine powders do.	287	316	313	330	e290
Metallurgical do.	52	45	26	13	e12
Total do.	4,662	4,207	4,366	3,787	e3,432
Quartz silica sand do.	213	262	223	232	233
Sulfur:					
S content of pyrite do.	r211	r214	248	276	313
Byproduct:					
Of metallurgy do.	264	265	257	260	e230
Of petroleum do.	48	45	e45	42	e40
Total do.	r523	r524	550	578	e583
Sulfuric acid do.	1,149	r1,165	1,462	1,359	1,160
Talc do.	318	327	319	284	319
Titania concentrate: Ilmenite:					
Gross weight do.	164	167	58	--	--
TiO_2 content do.	74	75	24	--	--
Wollastonite	15,402	14,669	16,917	16,795	16,000
Peat:					
For fuel use thousand tons	3,555	2,713	3,140	r e3,600	e2,100
For agriculture and other uses do.	275	r246	346	r e400	e233
Petroleum refinery products thousand 42-gallon barrels	r73,600	73,500	72,500	65,300	73,400

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through July 22, 1988.

[2]Includes approximately 30% of unused roasted pyrite (purple ore) from the Kokkola works.

TRADE

Exports of ferrochrome increased significantly in 1986 in line with increased production. Exports of steel semimanufactures increased as exports of primary steel decreased. Exports of peat briquets increased in 1986.

Imports of copper concentrate increased significantly in 1986 as domestic output decreased somewhat. Chalk imports increased, and ammonia imports decreased, both significantly. Sulfur imports decreased in 1986, and this was partially offset by increased domestic production. Imports of electricity increased in 1987.

Table 2.—Finland: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	13	13	--	Sweden 10; Norway 2.
Metal including alloys:				
Scrap	90	40	--	West Germany 37; United Kingdom 3.
Unwrought	16,171	16,974	--	Japan 8,553; Sweden 2,624; West Germany 2,447.
Semimanufactures	19,221	9,280	97	Sweden 2,264; France 1,129; United Kingdom 1,107.
Beryllium: Metal including alloys, all forms	--	(*)	--	NA.
Chromium: Ore and concentrate	177,153	161,387	--	Sweden 153,063; Poland 6,820; Norway 365.
Cobalt: Oxides and hydroxides	535	522	10	Netherlands 365; Italy 35; Hungary 30.
Copper: Metal including alloys:				
Scrap	2,275	1,162	--	Belgium-Luxembourg 608; Sweden 422; West Germany 106.
Unwrought	18,759	22,761	17	United Kingdom 8,861; Sweden 3,935; East Germany 2,540.
Semimanufactures	44,475	51,949	2,374	West Germany 9,757; United Kingdom 9,278; Italy 6,853.
Iron and steel:				
Iron ore and concentrate, pyrite, roasted	--	1,625	--	All to Netherlands.
Metal:				
Scrap	9,646	359	--	West Germany 167; Netherlands 160; Sweden 18.
Pig iron, cast iron, related materials	2	111	--	Sweden 82; Belgium-Luxembourg 24; Norway 2.
Ferroalloys, unspecified	56,311	90,231	14,511	France 21,666; Sweden 17,898.
Steel, primary forms value, thousands	$86,675	$53,248	$2,680	West Germany $24,897; United Kingdom $6,459; Morocco $5,995.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	$72,979	$97,338	$2,820	Sweden $22,593; West Germany $21,779; United Kingdom $10,501.
Universals, plates, sheets do	$350,417	$433,914	$57,688	West Germany $64,999; Denmark $51,089.
Hoop and strip do	$20,796	$24,477	$14	West Germany $3,116; Netherlands $2,143; unspecified $14,186.
Rails and accessories	206	281	(*)	Sweden 225; Norway 50; U.S.S.R. 3.
Wire	10,325	9,268	53	Sweden 5,635; Denmark 1,814; Norway 790.
Tubes, pipes, fittings value, thousands	$67,274	$90,555	$943	Sweden $31,200; U.S.S.R. $8,516; Norway $8,043.
Castings and forgings, rough do	3,888	7,602	--	Sweden 3,588; U.S.S.R. 1,832; West Germany 597.
Lead:				
Ore and concentrate	6,105	3,927	--	All to West Germany.
Oxides	(*)	71	--	Norway 40; West Germany 22; Sweden 9.
Metal including alloys:				
Scrap	1,044	1,415	--	West Germany 1,350; Sweden 65.
Unwrought	83	227	--	Sweden 150; West Germany 72; U.S.S.R. 5.
Semimanufactures	24	24	--	Sweden 18; U.S.S.R. 6.
Magnesium: Metal including alloys, scrap	174	184	--	West Germany 142; Italy 42.
Mercury 76-pound flasks	3,132	2,349	--	Switzerland 1,015; Netherlands 609; India 493.
Molybdenum: Metal including alloys, all forms	1	--		
Nickel: Metal including alloys:				
Scrap	1,777	59	--	All to Netherlands.
Unwrought	13,852	15,086	5,144	United Kingdom 1,698; West Germany 1,561.
Semimanufactures	3	1	--	All to Sweden.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$151	$516	--	United Kingdom $234; West Germany $150; Sweden $126.

See footnotes at end of table.

Table 2.—Finland: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Silver:				
Waste and sweepings[2] value, thousands	$3,618	$4,165	$1,923	United Kingdom $1,147; Sweden $844.
Metal including alloys, unwrought and partly wrought ——do.	$7,517	$6,317	$274	United Kingdom $3,541; West Germany $1,216; Sweden $806.
Tin: Metal including alloys:				
Scrap	35	23	--	United Kingdom 12; West Germany 11.
Unwrought	1	--	--	
Semimanufactures	(3)	1	--	Mainly to Libya.
Titanium: Oxides value, thousands	$4,015	$4,781	NA	NA.
Tungsten: Metal including alloys, all forms	11	12	--	West Germany 7; Belgium-Luxembourg 4.
Zinc:				
Oxides	47	9	--	U.S.S.R. 5; Nigeria 4.
Metal including alloys:				
Scrap	436	1,209	--	West Germany 715; Sweden 263; Norway 214.
Unwrought	140,364	127,756	21,505	Netherlands 23,412; United Kingdom 22,262.
Semimanufactures	68	252	(3)	U.S.S.R. 184; Norway 40; Sweden 19.
Other:				
Ores and concentrates	--	3,111	--	France 3,062; Sweden 49.
Ashes and residues	6,844	8,027	--	Sweden 4,673; East Germany 1,935; West Germany 1,344.
Base metals including alloys, all forms	1,683	1,510	282	United Kingdom 324; Netherlands 263.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Artificial: Corundum	7	--		
Grinding and polishing wheels and stones	147	131	1	U.S.S.R. 57; Poland 29; Sweden 23.
Barite and witherite value, thousands	$342	$440	--	West Germany $437; Philippines $3.
Boron materials:				
Crude natural borates	11	70	--	Denmark 50; Czechoslovakia 20.
Oxides and acids	(3)	--		
Cement	6,521	9,566	--	U.S.S.R. 7,772; Sweden 1,011; Norway 618.
Chalk	37	--		
Clays, crude	655	1,772	--	Netherlands 1,003; Sweden 740; Denmark 23.
Cryolite and chiolite	--	15	15	
Diamond:				
Gem, not set or strung value, thousands	$213	$45	--	Japan $24; Switzerland $14; Sweden $6.
Industrial stones ——do.	$2	$1	--	All to Sweden.
Diatomite and other infusorial earth	10	21	--	Venezuela 20; West Germany 1.
Feldspar, fluorspar, related materials	35,209	40,338	--	United Kingdom 23,637; West Germany 10,668; Poland 1,709.
Fertilizer materials:				
Crude, n.e.s	2,014	139	--	Bahrain 79; United Arab Emirates 60.
Manufactured:				
Ammonia	2	3	--	All to Ethiopia.
Nitrogenous	15,810	19,503	--	Switzerland 17,582; Denmark 1,806; Sweden 113.
Phosphatic	10	39	--	Sweden 19; U.S.S.R. 13; Sudan 7.
Potassic value, thousands	$10,155	$13,852	--	Pakistan $6,221; Algeria $2,771; Cuba $2,212.
Unspecified and mixed ——do.	$91,685	$72,309	$1,114	U.S.S.R. $25,425; China $14,172; Saudi Arabia $12,206.
Gypsum and plaster	--	7	--	All to U.S.S.R.
Lime	2,285	1,678	--	Sweden 890; West Germany 580; Italy 120.
Magnesium compounds	1,860	503	--	All to Sweden.
Mica:				
Crude including splittings and waste	566	274	--	West Germany 114; United Kingdom 68; Japan 56.
Worked including agglomerated splittings	(3)	--		
Nitrates, crude	--	29	--	All to United Kingdom.

See footnotes at end of table.

Table 2.—Finland: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Pigments, mineral: Iron oxides and hydroxides, processed	1	2	--	Vietnam 1.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$16	$37	--	Switzerland $19; Hong Kong $8; West Germany $7.
Synthetic do.	$83	$113	--	Belgium-Luxembourg $7b; Sweden $33; Netherlands $2.
Pyrite, unroasted do.	$1,401	$3,700	--	West Germany $2,794; Netherlands $584; Sweden $232.
Salt and brine	135	151	--	Sweden 64; United Kingdom 52; Netherlands 16.
Sodium compounds, n.e.s.: Carbonate, manufactured	56	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	271,905	222,011	767	Italy 119,262; Spain 33,618; France 32,200.
Worked	2,812	5,305	31	West Germany 2,336; Sweden 814; U.S.S.R. 690.
Dolomite, chiefly refractory-grade	--	133	--	All to Sweden.
Gravel and crushed rock	9,689	15,551	8	Sweden 12,958; West Germany 1,980; Nigeria 30.
Limestone other than dimension	3,271	3,876	--	All to Sweden.
Quartz and quartzite	6,922	5,831	--	Netherlands 3,200; Sweden 1,653; Portugal 199.
Sand other than metal-bearing	17,774	2,756	--	U.S.S.R. 1,908; Sweden 707; Cameroon 90.
Sulfur:				
Elemental, crude including native and byproduct	--	4	--	All to Nigeria.
Sulfuric acid value, thousands	$889	$1,699	$335	Belgium-Luxembourg $689; Denmark $334.
Talc, steatite, soapstone, pyrophyllite	52,634	48,284	--	Sweden 12,044; Netherlands 8,504; United Kingdom 8,160.
Other:				
Crude	14,060	16,638	2	West Germany 8,480; Italy 2,381; France 1,583.
Slag and dross, not metal-bearing	338	1,019	--	Sweden 427; U.S.S.R. 400; West Germany 106.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,696	1,892	--	U.S.S.R. 1,654; Sweden 238.
Carbon black	2,758	1,902	--	Ireland 1,898; Nigeria 4.
Coal:				
Anthracite and bituminous	19,209	4	--	U.S.S.R. 2.
Briquets of anthracite and bituminous coal	--	81	--	All to Norway.
Lignite including briquets	31	22	--	Do.
Coke and semicoke	13,223	9,571	--	Norway 7,170; Netherlands 2,401.
Peat including briquets and litter	55,594	92,160	--	Sweden 47,444; Netherlands 20,799; Ireland 6,874.
Petroleum:				
Crude thousand 42-gallon barrels	--	4,508	--	All to Sweden.
Refinery products:				
Gasoline do.	6,680	4,865	--	Sweden 3,691; Denmark 778; United Kingdom 228.
Mineral jelly and wax do.	(2)	2	--	Mainly to Denmark.
Kerosene and jet fuel do.	723	1,004	--	Sweden 577; Denmark 284; Singapore 144.
Distillate fuel oil do.	8,437	5,344	--	Sweden 1,900; Denmark 1,896; West Germany 884.
Lubricants do.	258	323	--	U.S.S.R. 303; Sweden 19.
Residual fuel oil do.	245	952	--	United Kingdom 444; Belgium-Luxembourg 440; Poland 38.
Bitumen and other residues do.	1	1	--	Mainly to U.S.S.R.
Bituminous mixtures do.	(2)	(2)	--	Do.
Petroleum coke do.	453	523	--	Sweden 268; Denmark 151; Belgium-Luxembourg 48.

NA Not available.
[1]Table prepared by Josef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

Table 3.—Finland: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	3,368	1,687	--	Greece 1,500; Netherlands 155; Australia 19.
Oxides and hydroxides	29,416	30,159	109	West Germany 12,975; Spain 11,400; Hungary 4,857.
Metal including alloys:				
Scrap	33,317	46,177	--	U.S.S.R. 13,502; United Kingdom 9,521; West Germany 8,169.
Unwrought	20,328	21,601	--	U.S.S.R 7,097; Spain 2,561; Brazil 2,534.
Semimanufactures	29,655	34,579	--	Sweden 7,597; West Germany 6,282; Norway 5,754.
Beryllium: Metal including alloys, all forms	(e)	(e)	(e)	
Chromium:				
Ore and concentrate	3	1	--	All from Netherlands.
Oxides and hydroxides	709	1,261	(e)	Poland 441; United Kingdom 435; West Germany 337.
Cobalt: Oxides and hydroxides	(e)	(e)	--	Mainly from Netherlands.
Columbium and tantalum: Metal including alloys, all forms, tantalum	(e)	1	(e)	Mainly from West Germany.
Copper:				
Ore and concentrate	152,619	187,820	16,650	Sweden 48,979; Norway 42,946; Bulgaria 23,024.
Matte and speiss including cement copper	1	(e)	--	All from West Germany.
Metal including alloys:				
Scrap	438	114	41	United Kingdom 27; Italy 23.
Unwrought	22,357	16,596	--	U.S.S.R. 10,051; Zaire 3,598; Zambia 2,001.
Semimanufactures	19,017	23,656	42	West Germany 9,337; Sweden 5,763; United Kingdom 3,554.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite -- thousand tons	1,756	1,987	--	Sweden 1,225; U.S.S.R. 643; Norway 119.
Metal:				
Scrap	113,350	63,339	--	U.S.S.R. 50,041; United Kingdom 13,221; Sweden 46.
Pig iron, cast iron, related materials	20,174	18,621	1	West Germany 5,731; Canada 4,990; United Kingdom 3,483.
Ferroalloys:				
Ferromanganese	4,294	4,496	--	Norway 2,321; West Germany 1,150; France 1,005.
Unspecified	49,620	39,588	37	U.S.S.R. 10,999; Norway 9,752; Greece 5,769.
Steel, primary forms	46,601	19,103	--	West Germany 14,018; Netherlands 3,422; Sweden 776.
Semimanufactures:				
Bars, rods, angles, shapes, sections	231,002	260,058	8	Sweden 59,356; West Germany 35,890; France 29,969.
Universals, plates, sheets	232,566	225,111	1	Sweden 42,555; West Germany 32,184; United Kingdom 26,461.
Hoop and strip	30,304	30,602	4	Sweden 13,341; West Germany 7,351; Belgium-Luxembourg 3,071.
Rails and accessories	2,542	3,076	(e)	West Germany 1,501; Austria 725; Belgium-Luxembourg 520.
Wire	23,352	21,332	106	Sweden 7,140; Belgium-Luxembourg 3,901; West Germany 2,076.
Tubes, pipes, fittings	130,173	122,590	46	West Germany 32,238; United Kingdom 17,628; Czechoslovakia 15,716.
Castings and forgings, rough	4,118	4,740	(e)	West Germany 1,336; Sweden 888; United Kingdom 627.
Lead:				
Ore and concentrate	91	--		
Oxides	174	450	6	West Germany 397; East Germany 35; Denmark 7.
Metal including alloys:				
Scrap	--	10	--	All from Sweden.
Unwrought	19,578	15,771	--	Sweden 7,177; U.S.S.R. 6,515; United Kingdom 1,296.
Semimanufactures	823	800	(e)	Sweden 362; West Germany 324; Belgium-Luxembourg 108.
Magnesium: Metal including alloys:				
Scrap	3	--		
Unwrought	87	149	--	Norway 82; Netherlands 23; Greece 21.
Semimanufactures	906	884	(e)	Norway 853; Italy 22; West Germany 5.

See footnotes at end of table.

Table 3.—Finland: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986: United States	Sources, 1986: Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate, metallurgical-grade	10,845	2,265	--	Morocco 1,200; Netherlands 1,045; Norway 20.
Oxides	744	425	--	Netherlands 198; Belgium-Luxembourg 164; Brazil 60.
Mercury, 76-pound flasks	29	(2)	--	Mainly from West Germany.
Molybdenum: Metal including alloys, all forms	6	2	(2)	Austria 1.
Nickel:				
Ore and concentrate	13,661	10,971	19	Norway 10,945; China 6.
Matte and speiss	9,759	9,267	--	Australia 6,663; Canada 2,604.
Metal including alloys:				
Scrap	2,618	3,839	--	Netherlands 3,800; Canada 36.
Unwrought	5,083	2,735	170	Canada 2,025; U.S.S.R. 512.
Semimanufactures	76	87	14	West Germany 30; United Kingdom 17.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, value, thousands	$603	$1,915	$15	United Kingdom $1,622; Sweden $127; Switzerland $86.
Silver:				
Waste and sweepings[3] do.	$125	$37	--	Sweden $22; West Germany $15.
Metal including alloys, unwrought and partly wrought do.	$5,330	$6,232	$11	Sweden $3,416; West Germany $897; France $745.
Tin: Metal including alloys:				
Unwrought	112	214	--	Brazil 92; West Germany 35; Netherlands 31.
Semimanufactures	114	186	(2)	United Kingdom 127; West Germany 43; Belgium-Luxembourg 8.
Titanium: Oxides	926	545	200	West Germany 285; United Kingdom 41.
Tungsten: Metal including alloys, all forms	18	23	16	Portugal 3; West Germany 2.
Uranium and/or thorium: Metal including alloys, all forms, value, thousands	$2	$4	--	West Germany $3; United Kingdom $1.
Zinc:				
Ore and concentrate	193,143	189,686	--	Sweden 70,506; Canada 62,583; Greenland 21,805.
Oxides	359	297	--	West Germany 204; Spain 42; United Kingdom 31.
Metal including alloys:				
Scrap	80	77	--	All from United Kingdom.
Unwrought	104	79	--	Norway 41; Netherlands 36; U.S.S.R. 2.
Semimanufactures	739	18	1	Norway 424; West Germany 55; Belgium-Luxembourg 39.
Other:				
Ores and concentrates, value, thousands	$8,192	$12,299	$694	Norway $7,746; Australia $3,097.
Ashes and residues	14,921	2,365	594	Netherlands 735; Australia 506.
Base metals including alloys, all forms, value, thousands	$6,626	$6,612	$756	Zaire $2,680; West Germany $924.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	14,712	490	--	Greece 284; Sweden 39; United Kingdom 8.
Artificial: Corundum	1,110	1,543	4	Austria 683; United Kingdom 264; West Germany 169.
Dust and powder of precious and semiprecious stones including diamond, value, thousands	$14	$19	--	Sweden $5; Ireland $4; Japan $4.
Grinding and polishing wheels and stones	2,411	2,378	16	West Germany 625; Austria 544; Sweden 176.
Asbestos, crude	2,479	2,165	--	Canada 1,622; Zimbabwe 210; U.S.S.R. 134.
Barite and witherite	1,721	1,769	--	West Germany 1,124; United Kingdom 390; China 216.
Boron materials:				
Crude natural borates	15,098	13,929	129	Turkey 13,800.
Oxides and acids	1,038	1,204	29	Turkey 712; Italy 351; France 44.

See footnotes at end of table.

Table 3.—Finland: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Cement	33,297	49,919	(2)	East Germany 16,335; U.S.S.R. 8,854; Denmark 5,607.
Chalk	119,702	162,420	3	Denmark 110,987; West Germany 38,344; United Kingdom 8,073.
Clays, crude	614,565	669,429	23,449	United Kingdom 591,971; West Germany 17,771.
Cryolite and chiolite	28	40	--	All from Denmark.
Diamond:				
Gem, not set or strung value, thousands	$3,946	$4,559	--	Belgium-Luxembourg $2,513; Israel $752; Switzerland $643.
Industrial stones do.	$86	$193	$8	West Germany $76; Belgium-Luxembourg $69; Switzerland $33.
Diatomite and other infusorial earth	4,739	5,506	621	Norway 2,529; United Kingdom 666; Denmark 644.
Feldspar, fluorspar, related materials	8,665	6,422	--	Mexico 6,088; Sweden 236; United Kingdom 98.
Fertilizer materials:				
Crude, n.e.s	54	47	--	All from United Kingdom.
Manufactured:				
Ammonia	351,932	252,051	32,060	U.S.S.R. 193,702; Netherlands 16,011.
Nitrogenous	27,968	52,576	(3)	Netherlands 19,749; Norway 13,118; U.S.S.R. 8,837.
Phosphatic	20	4	--	China 3.
Potassic value, thousands	$38,187	$38,479	$2	U.S.S.R. $13,628; East Germany $11,808; West Germany $6,242.
Unspecified and mixed	50,260	27,369	(3)	Romania 11,001; Hungary 10,028; Netherlands 4,246.
Graphite, natural	84	82	--	Sweden 75; West Germany 4; United Kingdom 2.
Gypsum and plaster	169,031	185,773	34	Spain 134,425; East Germany 30,634; U.S.S.R. 13,695.
Lime	7,540	7,467	--	Denmark 5,776; Sweden 1,675; Switzerland 40.
Magnesium compounds	17,631	9,520	7	China 6,455; Spain 2,350; Austria 380.
Mica:				
Crude including splittings and waste	248	276	--	United Kingdom 216; Norway 34; West Germany 20.
Worked including agglomerated splittings	30	38	--	Switzerland 19; Austria 7; Sweden 4.
Nitrates, crude	190	69	--	Chile 40; Poland 20; France 5.
Phosphates, crude value, thousands	$16,014	$9,044	$4,961	Morocco $2,346; Algeria $1,722.
Pigments, mineral: Iron oxides and hydroxides, processed	3,206	2,338	27	Belgium-Luxembourg 1,884; United Kingdom 377.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$246	$399	--	West Germany $160; Switzerland $85; Thailand $71.
Synthetic do.	$814	$814	$591	Switzerland $81; Austria $55.
Pyrite, unroasted	13	8	--	West Germany 7.
Salt and brine	398,805	526,892	5	Netherlands 190,256; Poland 142,392; West Germany 67,040.
Sodium compounds, n.e.s.: Carbonate, manufactured	58,450	52,643	--	Poland 21,617; U.S.S.R. 13,610; East Germany 9,754.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	1,725	2,011	--	Norway 1,458; Italy 197; Sweden 161.
Worked	2,474	3,238	--	Italy 1,458; Sweden 644; France 518.
Dolomite, chiefly refractory-grade	14,421	10,458	--	West Germany 4,234; Belgium-Luxembourg 3,050; Sweden 2,051.
Gravel and crushed rock	18,513	19,610	6	Sweden 14,756; Norway 3,192; West Germany 1,250.
Limestone other than dimension	738,516	755,261	25	Sweden 732,375; Denmark 1,711; United Kingdom 1,022.
Quartz and quartzite	158	290	52	West Germany 55; Netherlands 50.
Sand other than metal-bearing	61,508	43,400	--	Belgium-Luxembourg 31,111; Denmark 12,986; Sweden 8,335.

See footnotes at end of table.

Table 3.—Finland: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and by-product	78,377	28,183	--	West Germany 15,106; Poland 11,885; Sweden 1,187.
Colloidal, precipitated, sublimed	514	13	--	West Germany 12.
Sulfuric acid	22,156	340	--	U.S.S.R. 267; West Germany 40; Netherlands 32.
Talc, steatite, soapstone, pyrophyllite	577	424	--	Belgium-Luxembourg 276; Norway 61; West Germany 26.
Other:				
Crude	65,127	67,939	29	Norway 51,126; Sweden 15,217; U.S.S.R. 718.
Slag and dross, not metal-bearing	37,632	49,617	--	East Germany 26,494; Sweden 21,523; Norway 1,505.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	687	355	31	Trinidad and Tobago 318; United Kingdom 6.
Carbon black	9,934	10,157	102	Netherlands 3,958; Sweden 3,360; West Germany 2,156.
Coal:				
Anthracite and bituminous thousand tons	5,099	5,454	396	Poland 2,460; U.S.S.R. 1,551; Colombia 609.
Lignite including briquets do.	7	6	--	All from East Germany.
Coke and semicoke do.	1,231	1,109	--	U.S.S.R. 718; United Kingdom 143; Sweden 125.
Peat including briquets and litter	274	63	--	Burundi 33; U.S.S.R. 14; Sweden 12.
Petroleum:				
Crude thousand 42-gallon barrels	71,743	73,013	--	U.S.S.R. 62,566; Saudi Arabia 6,935; United Kingdom 1,319.
Refinery products:				
Liquefied petroleum gas[4] value, thousands	$760,619	$125,020	--	U.S.S.R. $124,884; Italy $64; Netherlands $62.
Gasoline thousand 42-gallon barrels	253	418	(2)	Sweden 259; Netherlands 128; Belgium-Luxembourg 17.
Mineral jelly and wax do.	106	88	(2)	West Germany 56; Hungary 14; China 6.
Kerosene and jet fuel do.	130	182	--	Spain 144; U.S.S.R. 31; Netherlands 5.
Distillate fuel oil do.	8,287	10,584	--	U.S.S.R. 10,582.
Lubricants do.	1,129	934	7	Italy 153; United Kingdom 150; Netherlands 144.
Residual fuel oil do.	11,325	13,970	--	All from U.S.S.R.
Bitumen and other residues do.	286	316	--	Sweden 158; Netherlands 105; Denmark 46.
Bituminous mixtures do.	33	7	2	Belgium-Luxembourg 2; Sweden 1.
Petroleum coke do.	259	306	302	United Kingdom 2; West Germany 1.

[1]Table prepared by Josef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.
[4]May include natural gas.

COMMODITY REVIEW

METALS

Cobalt.—Outokumpu ceased mining cobalt ore in May. Cobalt reserves at its Keretti Mine were nearing exhaustion and the operation had become unprofitable. Meanwhile, the company also terminated production of standard grades of cobalt metal, including standard grades of cobalt powder, at its Kokkola smelter. Outokumpu revealed that it would continue to produce cobalt salts and premium-quality superfine powders at its Kokkola works using concentrate from the Greenvale Mine in Queensland, Australia, on the basis of a 6-year contract signed in the fall of 1986. The company estimated that annual future production would be 1,100 tons of cobalt in salts and 400 tons of superfine metal powder. Production by Outokumpu of cobalt in salts increased by 41% in 1987 to 760 tons.

Copper.—Mined copper, nearly all produced by Outokumpu, decreased for the fourth consecutive year, mainly because of shrinking ore reserves. Production had decreased by nearly 50% since 1983, and most of the country's copper concentrate demand was met by imports. Two copper mines were closed permanently. In July, Outokumpu closed the Hammaslahti Mine, which produced about 3,000 tons per year of copper in concentrate as a coproduct with zinc concentrate; in April, the company closed the Kotalahti Mine, which produced about 500 tons of per year of copper in concentrate as a byproduct of nickel mining. The large Keretti Mine, which produced nearly one-half of Finland's copper concentrate, also was closed in April, but it resumed production in July with Government subsidies, primarily to avoid unemployment. Outokumpu actively sought additional foreign sources of copper feed material to support its domestic copper metal industry. It procured part ownership in two Norwegian mines, the Folldal Verk Mine and the Grong Gruber Mine, each of which produced annually about 25,000 tons of copper in concentrate as well as zinc concentrate. The venture, Norsulfid A/S, was owned jointly on a 50-50 basis with Orkla-Borregard A/S, a Norwegian firm. Most of the copper concentrate was destined for Outokumpu's Harjavalta smelter in Finland. Development of this new feed source was offset by closure in 1987 of the Lokken Mine in Norway, which had been a source of feed material for Outokumpu.

Four of Outokumpu's copper mines remained in operation in Finland at yearend. In addition, a minor quantity of byproduct copper concentrate was produced by Rautaruukki Oy at its Rautavaara iron mine.

The Harjavalta smelter was closed for 2 months during the summer for installation of a new $23 million flash-smelting furnace that increased smelting capacity by 25% to 100,000 tons of copper per year. The new process was claimed to increase metal yields from copper and nickel ores. The product copper anodes were subsequently refined electrolytically at the Pori works. About 11,000 tons of anode production was lost during the shutdown, and refinery production was reduced during that time by about 50%. However, smooth operation resumed in the fall at both facilities.

Iron and Steel.—Rautaruukki Oy, the large Government-owned steel company with more than 80% of Finland's steel production, signed an agreement early in the year with Ovako Steel Oy Ab, a Finnish specialty steel manufacturer, giving Rautaruukki control of all of Finland's production of ordinary steel. The agreement became effective on June 1. Ovako transferred its Koverhar 450,000-ton-per-year steel-rolling billet works and three steel semimanufacturing mills to Dalsbruk Oy, a new Rautaruukki division in which Ovako held a 20% share. Rautaruukki was studying a plan to construct a new billet caster at its large 2-million-ton-per-year Raahe crude steelworks to take full advantage of the plant's smelting capacity. The company indicated that this could affect the future of the Koverhar mill.

Rautaruukki completed construction of a new coke plant on schedule in October. The plant was designed to supply two-thirds of the coke requirements of the Raahe works.

Outokumpu finished construction of a new $125 million hot-rolling mill at its Tornio works, making it a vertically integrated producer of stainless steel semifabricated products, beginning with its chromite and nickel mines. Rolling mill trial runs began before yearend.

Nickel.—Outokumpu's Kotalahti nickel mine closed in April because of ore exhaustion after 27 years of operation. The mine produced about 1,700 tons of nickel in concentrate during 1986. Restart of the Hitura nickel mine was postponed; excavation was

halted with no final decision on whether the operation might resume later. The mine had been idled in 1985 because of low nickel prices and limited reserves, sufficient for 1.5 years. Outokumpu continued operation of its two other nickel mines, and the firm's total production decreased by 12% to about 9,900 tons of nickel in concentrate during 1987. Approximately 75% of this production was from the new Enonkoski Mine, and the balance was from the Vammala Mine. Myllykoski Oy also produced a minor amount of nickel concentrate as a byproduct from its talc beneficiation mill at Luikonlahti, Kuopio.

INDUSTRIAL MINERALS

Mica.—Kemira Oy, Finland's large state-owned fertilizer and chemicals company, began production of phlogopite flake as a byproduct of its phosphate rock mine at Siilinjarva in central Finland. The mica beneficiation and comminution plant had been constructed in 1985, started up in 1986, and came on-stream in early 1987 with an annual capacity of 16,000 tons. Wet ground flake was available in nominal sizes ranging from 40 to 900 micrometers for use as fillers, pigments, and plastic reinforcements. Total 1987 sales, mostly to Western European and Japanese markets, was about 2,000 tons.

Nitrogen.—A 90,000-ton-per-year ammonia plant was under construction by Kemira at Oulu, a port on the northern part of the Gulf of Bothnia. An old ammonia plant based on naphtha that had been closed in 1979 was being converted to a plant based on peat as raw material. Completion, scheduled for 1989, was expected to increase domestic production sufficiently to supply nearly 50% of domestic consumption. The plant was designed to consume approximately 240,000 tons of peat per year. Meanwhile, Finland was dependent on exports for about three-quarters of its ammonia supply.

Phosphate Rock.—Kemira confirmed its tentative plan to open in 1992 its new Sokli phosphate rock mine and beneficiation plant in the Finnish Lapland about 60 miles north of the Arctic Circle, at an estimated cost of $275 million. The concentrate was to be pipelined 225 miles to Finland's west coast port of Kemi. Most would be exported to Kemira's fertilizer plants in Belgium and Denmark. The Sokli complex was expected to produce about 2 million tons of concentrate per year, and estimated reserves appeared to be sufficient for about 20 years of production. The ore body is reportedly one of the world's largest carbonatite deposits and its apatite is free of cadmium, which had been an environmental problem in Western Europe. Construction was expected to begin in 1989 after issuance of a mining permit and after completion of additional feasibility studies based on economic and political factors. The company had not applied for the permit by yearend.

Sulfur.—Output of pyrite concentrate increased at Outokumpu's Pyhasalmi Mine, Finland's only remaining domestic source of pyrite, as a result of temporary mining of a pocket of ore particularly high in pyrite content. Revised data on proven reserves showed that there was enough for at least 20 years of mining.

Byproduct sulfur from metallurgical operations came principally from the smelting of zinc and copper concentrates, in order of volume. About two-thirds of these concentrates was imported. Until 1987, lesser amounts of sulfur, about 40,000 tons per year, were derived from the smelting at Kokkola of cobalt-bearing pyrites. This source of sulfur was discontinued in May.

Sulfuric acid demand for fertilizer manufacture, a major use, decreased. Outokumpu acquired full ownership from Kemira of the acid plants at its Harjavalta copper smelter, but Kemira retained ownership of the acid plant at Outokumpu's zinc smelter at Kokkola. Outokumpu sold most of the SO_2 gases from the zinc smelter to Kemira. Kemira converted some of the gases to acid on a toll basis for Outokumpu, which marketed the acid.

Talc.—A major talc deposit in northern Finland was being evaluated on a pilot basis by Myllykoski Oy, Finland's only private mining company. Myllykoski was the largest talc miner in Finland, producing about two-thirds of the country's beneficiated product, which contained about 97% talc. Domestic talc production was used mainly in the Finnish paper industry, as a substitute for imported kaolin.

MINERAL FUELS

Total consumption of mineral fuels increased by approximately 10% because of cold weather and growth in industry and transportation. Oil and gas imports, both primarily from the U.S.S.R., increased by about 10% and 40%, respectively. Hydro-

power output increased by about 10% while nuclear power and peat-generated power were stable. Finland remained about 65% dependent on imports for its energy supply; of this, 65% was oil, nearly all for use in transportation, followed by coal, 15%; natural gas, 10%; and electrical power, 10%. The domestically produced energy supply source breakdown was nuclear, 50%; hydro, 35%; and peat plus wood waste, 15%.

Finland's consumption of electrical power was among the highest per unit of the GDP in Europe, and demand was increasing. The fuel-source breakdown for electrical power production was nuclear, 32%; hydro, 24%; coal, 12%; peat and wood waste, 11%; electrical power imports, 11%; gas, 6%; and oil, 4%. Negotiations continued with the U.S.S.R., Sweden, and Norway regarding further importation of electrical energy. An agreement was signed with Sweden for construction of a 120-mile-long submarine cable across the lower part of the Gulf of Bothnia to Rauma in Finland. Design capacity was 400 megawatts (MW) of direct-current electrical power. Both Swedish and Norwegian power was to be delivered to Finland beginning in 1989. The newly elected Government approved in May a 10-year General Energy Plan that included construction of 1,100 MW of electrical powerplants burning peat, wood waste, coal, and gas at a projected total cost of about $1 billion. Preparations were being made to import 600 MW of power, generated by burning natural gas, from Norway beginning in 1993. Imports of natural gas from the U.S.S.R. were expected to increase. Negotiations regarding importation of gas from Norway via Sweden were begun but no definitive pipeline or gas delivery contracts were in sight.

Nuclear Power.—Four nuclear reactors were operating in Finland, two of Soviet and two of Swedish design, with a total electrical generation capacity of 2,300 MW. The Government had no plans to dismantle these plants, although construction of a fifth plant was canceled after the Chernobyl incident. Construction of future plants was postponed.

Peat.—Production of peat was down to about 50% of that planned because of a very wet summer. Sufficient stocks of fuel peat remained, because of high output in 1986, to last through the 1987-88 winter. A 150-MW peat-burning electrical powerplant was being built at Haakevesi at a cost of $160 million. A similar 120-MW plant at Seinaejoki was planned at a cost of $140 million. Peat-fired powerplants were near peat-mining sites to save transportation costs. Plant design usually included use of by-product thermal energy for district heating.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from finnmarks (Fmk) to U.S. dollars at the rate of Fmk4.4=US$1.00.

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